

# Cardiac Arrest Rhythms

Cardiac arrest means no heartbeat and no blood flow. V-fib and V-tach are wild, chaotic rhythms you shock to reset the heart. PEA and asystole mean the heart is too sick or empty to beat—so you do CPR and fix the cause (low fluid, no oxygen, clot in the lung, too much potassium, cold, poison, collapsed lung, fluid crushing the heart, or injury).

## THE ONE-LINE TRUTH

When the heart stops, it shows up in one of four rhythms on the monitor—two you can shock, two you cannot.

## The chain — how it unfolds

1. The heart stops beating (or beats uselessly), so blood stops flowing. — why: In V-fib the muscle just quivers; in V-tach it beats too fast to fill; in PEA the muscle cannot squeeze even though the spark is there; in asystole there is no spark at all. No matter the rhythm, the result is the same—zero blood pressure, zero pulse.
2. The brain runs out of oxygen within seconds and starts to die within four to six minutes. — why: The brain has no reserve; it depends on a constant flow of oxygen-rich blood every second. When blood stops, brain cells start dying. After ten minutes without any blood flow, most of the brain is permanently damaged.
3. The person collapses, is unresponsive, and stops breathing (or only gasps). — why: The brain controls consciousness and breathing. When it loses oxygen, the person blacks out instantly and the breathing center in the brainstem shuts down. You may see occasional gasps (called agonal breathing)—that is a reflex, not real breathing.
4. The skin turns pale or blue-gray (cyanosis), and the pupils get wide and do not react to light. — why: Without blood flow, oxygen leaves the blood in the skin and it looks dusky. The muscles that shrink the pupils need oxygen and stop working, so the pupils stay wide open.
5. The heart muscle itself runs out of oxygen and gets weaker, making it even harder to restart. — why: The heart feeds itself through small arteries (coronary arteries) that branch off the aorta. When the heart stops pumping, those arteries have no pressure and the heart muscle starves. The longer the arrest, the more damage to the heart—even if you get it started again, it may be too weak to pump well (this is why many people who survive cardiac arrest end up in the ICU on medicines or a pump to help the heart).

6. Other organs—kidneys, liver, intestines—start to fail because they are not getting blood either. — why: Every organ needs oxygen. The kidneys stop making urine, waste builds up in the blood, the intestines' lining starts to break down and leak bacteria into the bloodstream, and the liver cannot clean toxins. If the arrest lasts long or CPR quality is poor, multi-organ failure follows even if the heart restarts.
7. If CPR or defibrillation does not happen fast, the person will die—or survive with severe, permanent brain damage. — why: The brain is the most fragile organ. Even if you restart the heart after ten or fifteen minutes, the brain may be too damaged to wake up or function. That is why bystander CPR and early defibrillation (within the first few minutes) are the only things proven to save lives and brains in cardiac arrest.
8. Even after the heart restarts (called return of spontaneous circulation, or ROSC), the person often stays unconscious and needs ICU care—cooling the body, blood pressure support, breathing machine, and treatment for the cause—to protect the brain and keep the heart from stopping again. — why: Restarting the heart is only step one. The whole body has been through massive stress (ischemia-reperfusion injury—when blood flow suddenly comes back, it can create harmful chemicals and swelling). The team keeps the person cool (around 36°C) for 12–24 hours to slow brain swelling, watches for seizures, and fixes whatever caused the arrest (puts in a stent to open a blocked artery, drains fluid from around the heart, corrects electrolytes). Many people who get ROSC still die in the ICU or wake up with brain damage because the arrest lasted too long or CPR quality was not good enough.

## Spot it — what you see, and why

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- No pulse felt anywhere on the body: The heart has stopped pumping blood forward in a way that creates pressure in the arteries, so there is no wave of blood to feel under your fingers.
- No breathing or only gasping breaths (agonal breathing): The brain is not getting oxygen, so the breathing center shuts down or sends out uncoordinated signals that cause short, ineffective gasps.
- Unresponsive to any stimulus: Without blood flow, the brain loses oxygen within seconds and cannot process signals or send responses, so the person cannot wake up, talk, or move on purpose.
- Sudden collapse without warning: The heart's electrical system suddenly fails or becomes chaotic, stopping effective pumping instantly, and the person drops because the brain loses power immediately.
- Skin turns blue or gray (cyanosis), especially lips and fingertips: Blood is not carrying fresh oxygen to the body, so hemoglobin (the red protein in blood that carries oxygen) turns dark, making the skin look blue or gray through the surface.

- Pupils become wide and do not shrink when light is shined into the eyes: The brain stem, which controls pupil size, stops working without oxygen, so the pupils stay dilated (wide open) and do not react to light.

## Red flags — act now

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- No pulse and no breathing—start CPR immediately and call for help; every second without blood flow kills brain cells
- Rhythm on monitor is ventricular fibrillation (VF) or pulseless ventricular a fast heart rate (tachycardia) (VT)—shock with a defibrillator as soon as possible to try to reset the heart
- Flat line (asystole) or PEA rhythm—look for and fix reversible causes fast (low oxygen, low blood volume, heart squeeze from fluid around it, blood clot in lung, heart attack, low potassium or high potassium, overdose, low body temperature, tension in chest from collapsed lung)
- Person collapsed suddenly in front of you—survival depends on immediate high-quality chest compressions and early defibrillation; do not wait for advanced help to start CPR

## Treat it — in this order

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1. Start high-quality CPR immediately: push hard and fast on the center of the chest at 100–120 compressions per minute, let the chest come all the way back up after each push, and minimize pauses → Chest compressions squeeze the heart between the breastbone and the spine, forcing blood out to the brain and lungs. This keeps the brain alive while you work to restart the heart. High-quality CPR doubles or triples the chance of survival.
2. Defibrillate (shock) immediately if the monitor shows VF or pulseless VT — use 120–200 joules biphasic or 360 joules monophasic, then resume CPR for 2 minutes before checking rhythm again → The electrical shock stops all the chaotic signals in the heart muscle at once (depolarizes every cell). When the cells reset, the heart's natural pacemaker (the SA node) can take over and start an organized rhythm that pumps blood again.
3. Give epinephrine 1 mg IV or intraosseous (IO) every 3–5 minutes during the code → Epinephrine tightens blood vessels all over the body (alpha agonist), which raises blood pressure and pushes more blood to the heart and brain during CPR. It also makes the heart muscle more sensitive to shocks and more likely to restart.
4. Give amiodarone 300 mg IV or IO (first dose), then 150 mg IV if VF or pulseless VT continues after 2–3 shocks → Amiodarone slows down and stabilizes the chaotic electrical signals in the heart muscle (blocks sodium, potassium, and calcium channels). This makes it easier for the defibrillator shock to reset the rhythm and keeps the heart from going back into VF or VT right away.

5. Secure the airway with an endotracheal tube (ETT) or supraglottic airway (like an i-gel or King LT), then give breaths at 10 per minute with 100% oxygen while continuing compressions without pausing → A tube in the windpipe keeps the airway open and delivers pure oxygen directly into the lungs. This raises the oxygen level in the blood so CPR can carry oxygen to the brain and heart. It also prevents vomit from going into the lungs (aspiration).

## **Your top priorities at the bedside**

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1. Start chest compressions immediately within 10 seconds of finding no pulse, pushing at least 2 inches deep on the center of the chest at a rate of 100 to 120 compressions per minute — why: Brain cells die after 4 to 6 minutes without oxygen; chest compressions squeeze the heart to push blood to the brain and keep cells alive until the heart can be restarted
2. Apply defibrillator pads and check the rhythm within the first minute; if VF or pulseless VT is seen, deliver one shock immediately then resume compressions for 2 full minutes before checking rhythm again — why: VF and pulseless VT are disorganized electrical storms in the heart muscle; early defibrillation stops the storm and gives the heart a chance to restart in a normal rhythm before the muscle runs out of energy
3. Place an advanced airway (endotracheal tube or supraglottic airway) and give 1 breath every 6 seconds with 100 percent oxygen once compressions are ongoing; do not stop compressions to give breaths — why: The blood being pumped by compressions must carry oxygen to stay useful; however pausing compressions to breathe drops blood pressure to zero and wastes critical blood flow (perfusion) time